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Champaign County Solid Waste Management System Analysis

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INSTITUTE FOR
ENVIRONMENTAL
QUALITY

CHAMPAIGN COUNTY
SOLID WASTE MANAGEMENT SYSTEM ANALYSIS

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CHAMPAIGN COUNTY
SOLID WASTE MANAGEMENT
SYSTEM ANALYSIS

Roy F. Weston, Inc.

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Project No. 40.001

State of Illinois

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TABLE OF CONTENTS

Chapter I. General State Solid Waste Planning Program for Illinois	Page
A. The Need for Planning in Illinois	1
B. Solid Waste Plan	2
C. The Analytical Process	2
D. Resource Recovery	7
E. Use of this Report	8
F. Future Planning	8
Chapter II. Management Alternatives for Champaign County	
A. County Information	11
B. Present Problem	11
C. Computational Methods	11
D. Short-term Analysis	12

APPENDIX A - CHAMPAIGN COUNTY — Page

1. Geological Information — A-1
2. Population Projections - Table A-1 — A-2
3. Employment Projections - Table A-2 — A-3
4. Solid Waste Quantities by Source - Table A-3 — A-5

APPENDIX B - COST FUNCTIONS AND PLANNING FACTORS

1. Method for Calculating Municipal and Industrial Collection Rates — B-1
2. Industrial Waste Generation Factors-Table B-1 — B-3
3. Haul Cost Factor with Assumptions-Table B-2 — B-6
4. Cost Functions: Sanitary Landfill-Figure B-1 — B-9
5. Basic Landfill Cost Assumptions for 50,100, 250, 500, 1000, 2000 and 5000 Tons/Week - Tables B-3 to B-9 — B-10
6. Cost Functions: Intermediate Processing Facilities - Figure B-2 — B-18
7. Equations for Facility Cost Functions — B-19
8. Resource Recovery Facility Description — B-20
9. Resource Recovery Capital and Annual Cost Table B-10 — B-21

SOLID WASTE
MANAGEMENT PLANNING

The Need for Advance Planning in Illinois

In July, 1970, the Illinois General Assembly passed the Illinois Environmental Protection Act. This law expresses the determination of the people to improve the quality of the environment in Illinois. The Act addresses problems of air, water, land and noise pollution.

In 1973, the Illinois Pollution Control Board adopted new regulations for sanitary landfills. These regulations are enforced by the Illinois Environmental Protection Agency. The permit and inspection provisions established under these regulations are among the most comprehensive and vigorous in the United States. Each landfill operator is required to apply for a permit by April 27, 1974. The expense of meeting Illinois design and operating standards has and probably will cause some marginal landfill operations to close, thereby eliminating some environmentally unacceptable, but convenient, disposal sites.

The dwindling number of solid waste disposal sites has caused concern among municipal officials and private solid waste companies. Efforts to aquire new sites have often been thwarted by citizens who recognize the need for such facilities, but would rather see them located somewhere else.

The increased costs associated with everything these days have strained municipal budgets. Solid waste management is a large budget item. Elected officials are asking: Can this be reduced?

Over half of the solid waste in Illinois is managed by private companies. Their costs are increasing, and so are the rates charged to their clients. Public officials are asking: What is the cost of solid waste management? Should we go into business for ourselves?

In 1973, the energy crisis reinforced the long-standing argument by

environmentalists that something should be done to recover the resources going into solid waste. Solid waste managers now must cope with the added complexities of unproven recovery systems and an uncertain market for recovered commodities.

These and other pressing problems require planning. This study provides a basis for that planning by examining the economics of current solid waste management practices and proposed regional management strategies.

State Solid Waste Plan

The State Solid Waste Management Planning Project will examine the solid waste needs of Illinois and make recommendations as to actions that can be taken by the State to improve solid waste management generally. The Solid Waste Management Task Force of the Illinois Institute for Envi onmental Quality recognized from the start that solid waste management is a local responsibility and is subject to the specific desires of the people as to the services desired and the manner of satisfying these desires. Consequently, the task force suggested that the principal thrust of the State planning project should be to assist the work of local and regional planners who must prepare the specific recommendations for local officials.

This report is an analysis by the State and its consultants of several alternatives available to a specific region. Basic data used in the analysis was gathered by the regional planners, processed by the consultants, and rechecked by the regional planners. Elsewhere in the State plan, the planner will find reference data on the natural features of the State which will have an impact on solid waste management activities.

The Analytical Process

People and their activities produce solid waste. The first step in the planning procedure was to determine population and employment. Basic population projection data was generated by Argonne National Laboratory using historic census data and a predictive model. These projections were checked by the regional planner using local data and projections by the Illinois Office of Planning and Analysis (OPA). Tables 1 and 3 show examples of population and employment projections. Employment data was taken from the

Table 1

PROJECTED POPULATION EXAMPLE

LOCATION	1970	1975	1980	1985	1990	1995	2000
City A	305	305	350	360	390	400	410
City B	39,992	44,500	48,500	51,400	54,000	57,100	59,800
City C	2,435	2,780	3,010	3,230	3,440	3,690	3,910
City D	26,396	27,900	34,400	39,100	43,800	49,000	54,100
SUB TOTAL	69,128	75,385	86,260	94,090	101,630	110,190	118,220
UNINCORPORATED	21,754	23,400	24,200	24,800	25,300	25,900	26,400
COUNTY TOTAL	90,882	98,785	110,460	118,890	126,930	136,090	144,620

Table 2

AN ILLUSTRATION METHOD OF MUNICIPAL SOLID WASTE GENERATION

(1) Political Subdivision	(2) 1970 Population	(3) Area, ($mi.^2$)	(4) Population Density (2) ÷ (3)	(5) Log (4)	(6) 1.54 X (5)	(7) Generation Factor (6) - 0.68 #/cap./day	(8) Collection Rate (2) x (7) #/day	(9) Collection Rate (8) ÷ 285.7 ton/week
City A	305	0.17	1,794	3.25	5.01	4.33	1,320	4.6
City B	39,992	11.37	3,517	3.55	5.46	4.78	191,161	699.
City C	2,435	1.28	1,902	3.28	5.05	4.37	10,641	37.
City D	26,396	6.06	4,356	3.64	5.60	4.92	129,868	455.
Co. Remainder	21,358	1,157.	18.7	-	-	3.4	72,617	254.

Table 3

AN EXAMPLE OF THE EMPLOYMENT PROJECTIONS

SIC	1971	1975	1980	1985	1990	1995	2000
City B 207	1,000	1,000	1,000	1,000	1,000	1,000	1,000
2432	25	29	31	35	36	40	42
3272	3	0	0	0	0	0	0
358	1,500	2,470	2,750	3,020	3,220	3,630	4,010
City C 243	15	15	15	15	15	15	15
271	4	1	0	0	0	0	0
City D 275	15	21	27	32	37	43	49
278	60	79	100	140	170	210	240
301	225	225	225	225	225	225	225
327	32	32	35	35	35	35	35

Illinois Manufacturers' Association Directory as an historic data base. Employment projections are expressed in 3- and 4- digit Standard Industrial Classification (SIC) code (Table B-1, Appendix B).

Approved population projections are then multiplied by waste generation factors to give the municipal solid waste load (i.e. the residential and commercial wastes generated within a community).

Table 2 is an example of a tabular solution in which population is translated into a solid waste generation rate. (A more detailed explanation of the columns and the computational method is contained on Page B-1, Appendix B). Similarly, Table 4 gives a sample calculation in which employment is translated into tons of industrial wastes. The conversion factors (Table B-1, Appendix B) for converting employment data into tons of waste were derived by the consultant from data supplied by the USEPA. Table 5 shows, where there is no centrally located municipality, how the residential waste from unincorporated areas is allocated (on the basis of percentage of area) and combined with municipal and industrial wastes for the purpose of subsequent analyses. Wastes from unincorporated areas are considered to be located at the centroid of the township.

For long-term planning, consideration must be given to the annual change in generation rates. The computational methodology is shown on Table 6. A 2% and 3% per year increase in the generation factor was used for cities with more than 10,000 people and less than 10,000 people respectively.

Total waste quantities for the present (1973) and a future date (1990) are presented on Table 7. These waste quantities are, in turn, provided as input to a computerized model. The computer then determines the cost of hauling waste from the centroid of each source to each specified processing or disposal site. Transportation costs are added to site annual operating costs to determine a total annual system cost. It is within the capability of the computer model, if it is so instructed, to select the combinations of sources, processing facilities and ultimate sites which given the least (optimum) system cost.

Table 4

EXAMPLE OF INDUSTRIAL WASTE LOADING CALCULATION

(1) Location of Political Subdivision	(2) SIC Code	(3) Number of Employees in 1971	(4) Generation Factor (Ton/Empl/Yr)	(5) Production Rate (Ton/Yr) (3) x (4)	(6) Production Rate (Tons/Week) (5) ÷ 52	(7) Total Industrial Waste For Each Source (Ton/Week)
City A						0
City B	207	1,000	3.3	3,300.	63.4	
	2432	25	232.	5,800.	111.5	
	3272	9	154.	1,310	26.1	
	358	1,500	1.5	2,250	42.2	243.2
City C	243	15	21.7	3 325.5	6.3	6.3
City D	275	15	1.1	16.5	-	
	278	60	2.6	156.	3	
	301	225	3.7	833.	16	
	327	32	15.	480.	9.2	28.2

Table 5

EXAMPLE OF COMPOSITE LOADING SHEET FOR BASE YEAR - 1973

Source Name	I.D#	SIC Load (Ton/Week)	Municipal Load (Ton/Week)	Area for Division of County Remainder $(Miles)^2$	Load due to County Remainder (Ton/Week)	Total Load (Ton/Week)
City A	101	-	4.6	9.7	54.6	59.2
City B	102	243.2	699.	10.	56.3	998.5
City C	103	6.3	37.	10.4	58.6	101.9
City D	104	28.2	455.	15.	84.5	567.7
				45.1	253.98	
County Remainder -		-	254			1727.3

Table 6

AN EXAMPLE OF THE COMPOSITE SHEET FOR WASTE LOADS (Ton/Week) FOR 1990

Source Name	I.D.#	1990 Industrial Load (Ton/Week)	1970 Generation Rate (#/cap./day)	% Increase Per Year	Total % Increase	1990 Generation Factor (#/cap./day)	1990 Municipal Waste Loads (Ton/Week)	County Area Factor	County Remainder Based on Area (Ton/Week)	1990 Total Waste Loads (Ton/Week)
City A	101	-	4.33	3	60	6.9	9.4	36	94.3	103.7
City B	102	360	4.78	2	40	6.35	1264.	48	125.7	1389.7
City C	103	6	4.37	3	60	6.99	84.3	64	167.7	252.
City D	104	36	4.92	2	40	7.87	1207.	36	94.3	1301.3
County Remainder			3.4	3	60	5.44	482	184		3046.7

Table 7

EXAMPLE OF THE STUDY PERIOD SOURCE INVENTORY

SOURCE NAME	SOURCE ID NO.	1973 VALUES QUANTITY (Tons/Week)	1990 VALUE QUANTITY (Tons/Week)
City A	101	59.2	103.7
City B	102	998.5	1389.7
City C	103	101.9	252.
City D	104	567.7	1301.3

In addition to sources and waste quantities, the computer must be given cost parameters for transportation and for the operation of the solid waste management system specified. Unit costs for the disposal systems tend to be lower as the quantities increase. Such variable cost factors are best described by cost curves which were incorporated into the computer input. These cost curves are shown in Figs. B-1 and B-2, Appendix B.

In developing the planning factors and cost curves, the consultant was faced with the problem of picking a finite value for a given function when, in actuality, that function could be described by a range of values. The values given here are neither the highest nor the lowest, but an estimate of current conditions. They were adjusted to 1973 cost levels using the Engineering News-Record construction cost index. Where appropriate, assumptions are listed.

Computations do not include the cost of solid waste collection. It is assumed that, regardless of the management system used, the waste must be collected. Whether it is collected once a week or twice a week, at the curb or at the back door, in plastic bags or in 32 gallon cans, are matters of local preference. The alternatives addressed in this study include the cost of moving from the centroid of the collection area to an intermediate or final disposal site.

Aside from taking the drudgery out of the thousands of calculations required, the computerized model permits the planners to examine a range of management alternatives. The strategies thus examined and reported here were proposed and analyzed by the regional planner with assistance from the State's consultants.

Resource Recovery

These analyses take a conservative view of the economics of resource recovery alternatives. As of March, 1974, there were no large scale resource recovery systems operating in the United States. Certain demonstrations projects are operating successfully in Franklin, Ohio and St. Louis, Missouri. Larger systems have been designed and several are under construction. We can

predict operating and capital costs better than we can predict the off-setting revenues from the sale of recoverable resources. Table 9 gives recent prices for the secondary materials present in typical municipal waste. These prices are subject to the usual variations of the commodities market, as well as regional variations in transportation costs. Table 10 describes eight levels of resource recovery activities and the expected revenue (based on Table 9 prices). The decision to adopt a resource recovery system will entail an evaluation of the risk involved in the fluctuating market values.

Uses of This Report

The results of this analysis are intended to assist the regional planner in preparing recommendations for local decision makers. The analytical techniques used are based upon averages and generalized planning factors developed in 1973 and cannot be expected to reflect the exact local cost situation. The usefulness of this regional analysis is to show the relative economic merits of alternate management systems, thus enabling the planner to separate the most feasible alternatives from the least feasible.

This report includes basic data, planning factors, and sample calculations so that the regional planner can make specific adjustments later on. It is to be emphasized that the least cost solution is not necessarily the best. The recommended solution will be that which combines economy with regional desires and constraints. To prepare such recommendations is the task of the regional planner.

Future Planning

It is expected that regional planners will need to up-date their plans and to consider other strategies. It is the intention of the Illinois Institute for Environmental Quality to maintain the capability for providing these regional analyses.

TABLE 9

RESOURCE RECOVERY VALUE FOR FERROUS AND NONFERROUS METALS, GLASS, FIBERS AND HEAT VALUE

Materials Recovered	Conc. In MSW (%)	Recovery (%)	T /100T MSW	Delivered Price	Trans. Charge (5)	Net Credit	Credit $/Ton Of Input Solid Waste
Ferrous Metal (6)	7.5	100	7.5	$56	$ 46	$11.7	$ .82
#2 Bundle	7.5	100	7.5	20 (10-30)	6	10	0.75
Madison (3)	7.5			51	6	14	1.05
Scrap Steel Jan. 73 (4)				86	6	45	
Jan. 74 (4)						80	
Scrap Steel Incinerator Residue			7.5	12 (10-14)	5	7 (5-9)	.53 (.40-.72) (.42 (6))
Aluminum	1.0	100	1.	200	50	150	1.50
Copper Zinc Fraction	.5	100	.5	240	50	190	.95
Copper Scrap (Jan. 73) (4)				860	50	810	
(Jan. 74) (4)				1360	50	1310	
Tin Scrap (Madison (3))				4000	50	3950	
Glass (Sorted by color)	9.	44	4.	16	6	10	.40
Mixed Glass Fines	9.	70	6.3	5	6	- 1	-0.06
Fourth Forest Pulp	40. (Dry Basis)	45	18.	25	8	17	3.06
Newsprint (July 73) (4)			8	18	8	10	0.80
(Nov. 73) (4) Separated			8	35	8	27	2.16
(Jan. 74)			8	60	8	52	4.16
Paper (6)			15.			15	2.25
Energy Recovery							
Electric Energy (6)			6.67×10^4 Kwhr.			$.006/Kwhr.	4.00
Shredded Refuse Heat Value (7)			7.5×10^8 Btu/100 Ton			.50¢/M Btu	3.75
Total Combustible	75. (Wet Basis)	100	75.			(1.)	4.95
Combustible After Fiber Recovery	75. (Wet Basis)	66	50.			(2.)	3.3
Synthetic Fuel Oil (6)			4.80×10^8 Btu/Ton			$.8-/10^6$ Btu	3.36
Synthetic Fuel Gas (6)			6.7×10^8 Btu/Ton			$.50/10^6$ Btu	3.33
Steam			175	1.90 @ .95/1000#			3.33
			175				

1. Produces 450 Kilowatts-hours of Electricity/Ton, Valued at 1.1 Cent per Kilowatt-hours.
2. Producers 300 " " " " " " " " " " " "
3. From Madison Wisconsin Shredding and Landfill Operation.
4. Wall Street Journal - January 31, 1974
5. Transport Cost for 1973 Average Used Through-out, Value Fluctuates
6. Resource Recovery - The State of Technology, pg. 25
7. Commonwealth Edison 1974

This Table summarizes the by-product credits that may be realized by reclamation of recyclable materials from a ton of MSW. The credits reflect 1973 conditions and assume reasonable transportation charges to proximate recycling plants; i.e., the credits are based on delivered prices and representative concentrations of the salvaged materials in MSW. Extreme fluctuation can be seen in a one year period. Selection of appropriate value must be based on transport distance and market demand.

Table 10

TABLE OF RESOURCE RECOVERY VALUES FOR VARIOUS SYSTEMS

A. Small operation - magnetic separation of cans
$1.05/Ton of Input Municipal Solid Waste (M.S.W.)

B. Cans and Paper Recovered
$1.05 Cans
3.06 Paper - based on separate collection
$4.11/Ton of Input M.S.W.

C. Cans, Paper, Aluminum, Copper - Zinc Fraction Recovered
$1.05 Cans
3.06 Paper - separate collection
1.50 Aluminum
.95 Copper - Zinc Fraction
$6.56/Ton of Input M.S.W.

D. Cans, Paper, Aluminum, Copper-Zinc, and Fraction Heat Recovery
$1.05/T for Cans
3.06/T for Paper separate collection
1.50/T for Aluminum
.95/T for Copper-Zinc Fraction
3.00/T for Heat Recovery after Fiber Recovery
$9.56/Ton M.S.W. Input

E. Incineration with Residue Recovery. Recover only Steel Cans
$ .53 Cans from incinerator Residue

$ .53/Ton M.S.W

F. Metal Recovery, Heat Recovery, Heat Recovery of Shredded M.S.W.
$1.05/T for Magnetic can separation
1.50/T for Aluminum
.95/T for Copper-Zinc Fraction
3.75/T for Shredded Fuel Value

$7.25/T of Input M.S.W.

G. Incineration with Residue Recovery and Heat Recovery
$ .53/T for Cans from incinerator Residue
1.50/T for Aluminum
.95/T for Copper-Zinc Fraction
4.50/T for Heat Value

$8.00/T for Heat and Material Recovery of M.S.W.

H. Source separation and separate collection of newsprint
$ .80-4.16/Ton of input Municipal Solid Waste (M.S.W.)

CAUTION: This table shows the value of recovered resources for 8 theoretical recovery systems. It is based on the "credit $/Ton" column of Table 9, and is subject to the conditions and assumptions stated. Tables 9 and 10 may need to be modified to reflect local markets and transportation costs.

MANAGEMENT ALTERNATIVES FOR CHAMPAIGN COUNTY

Most solid waste in Champaign County is collected by private haulers for delivery to municipal landfills. A total of 16 landfill sites have been identified by the Champaign County Planning Commission and the Illinois Environmental Protection Agency (IEPA). Only eight of these sites had sufficient capacity to be considered in this study of present and future needs. Four of these sites belong to municipalities; one site belongs to Chanute Air Force Base - a federal installation; and two belong to private solid waste operations. The remaining sites are small and, for various reason, may not elect to apply for a State operating permit needed to remain in operation.

Present Problem

Three-forths of the County's waste is being taken to the two largest landfills in Champaign and Urbana. Both of these sites will reach their ultimate capacity in 1974 and have ceased taking out-of-town waste in the interest of saving landfill space. The regional planning agency is exploring the possibilities of establishing a regional system which could meet all County needs and assure good management and economy. To that end, this analysis will cover certain alternative courses of action as suggested by the regional planning agency and its consultant.

Computational Method

Projections of population and employment were calculated using the method described in Chapter 1. Results are tabulated in Tables 1, 2, and

3 of Appendix A. A summary of geological information for Champaign County (also Appendix A) indicates the general soil and groundwater conditions as they pertain to the construction of sanitary landfills.

Short-term Analysis

Short-term planning alternatives include those management systems which could be reasonably expected to be operational within two to three years of plan acceptance. Each alternative analyzed includes a description and a diagram(s) which summarize the waste sources, disposal sites, costs, and assumptions.

Alternative 1: Continuation of the Existing System (1973 Data)

The existing system is described by a diagram (p. 14) which summarizes the sources, sites, quantities, costs and assumptions. The system is confined to the county boundaries and the data provided in 1973. The unit cost of $6.01/ton is reasonable largely because most of the waste is going to the two larger landfills (501 and 508) which are located close to the principal sources (Champaign, Urbana, and the University of Illinois). The facility costs vary from $1.88/ton for the Urbana landfill to more than $7/ton for the small sites. The unused capacity of several of the landfills will be exhausted within the next year, eliminating 2 of the small sites.

Champaign County

Cost of Existing System as Indicated in 1973 Data Provided by the County Planning Agency

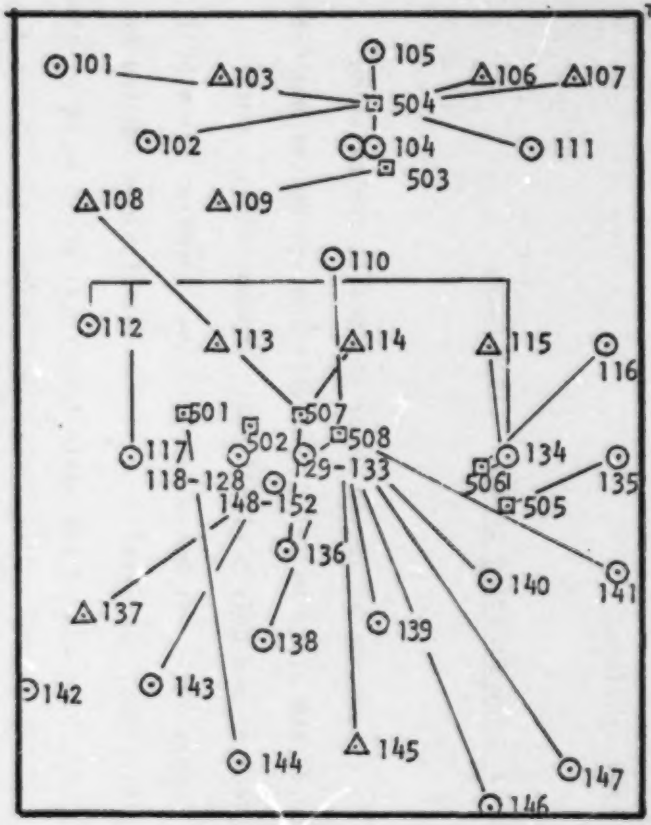
Alternative 1

Key:

___ From Source to Ultimate

- - From Source to Intermediate

. . From Intermediate to Ultimate



⊙ Sources

ID#	Name	T/W	ID#	Name	T/W
101	Foosland	17.	129	Urbana SE 8	143
102	Fisher	23.	130	Urbana SE16	143
103	East Bent T	56.	131	Urbana SE17	143
104	Rantoul 36	106.	132	Urbana SE20	143
105	Ludlow	22.	133	Urbana SE 7	143
106	Harwood T	14.	134	St. Joseph	43
107	Kerr T	10.	135	Ogden	29
108	Newcombe T	14.	136	Savoy	11.
109	Conduit T	14.	137	Colfax T	14.
110	Thomasboro	11.	138	Tolono	46.
111	Gifford	32.	139	Philo	30.
112	Mahomet	42.	140	Sidney	29.
113	Hensley T	13.	141	Homer	35
114	Somer T	13.	142	Ivesdale	19
115	Stanton T	13.	143	Sadorus	5
116	Royal	3.	144	Pesotum	21
117	Bondville	14.	145	Crittenden T	15
118	Champ SE 2	129.	146	Longview	18
119	Champ SE 11	129.	147	Broadlands	15
120	Champ SE 12	129.	148	U of I 1	53
121	Champ SE 12.5	129.	149	U of I 2	53
122	Champ SE 15	129.	150	U of I 3	53
123	Champ SE 14	129.	151	U of I 4	53
124	Champ SE 13	129.	152	U of I 5	54
125	Champ SE 26	129.	204	Rantoul 35	106
126	Champ SE 22	129.	205	Rantoul 34	156
127	Champ SE 23	129.	206	Rantoul 1	146
128	Champ SE 24	129.	207	Rantoul 2	56

Congested Area Source To Site Pairings

118-128	to 501 and 508
129-133	to 508
148-152	to 508
104	to 504
204-206	to 503
207	to 508

General Cost Analysis

Total Facility Annual Cost $469,309.8
Total System Haul Cost 628,017.
Total System Annual Cost $1,097,326.

Total System Annual Unit Cost $6.01/Ton

⊙ Intermediate Facilities

ID#	Name

⊡ Ultimate Facilities
Landfills

ID#	Name
* 501	Champ Mun.
* 502	Champ Whit
* 503	Chanute A.F.B.
* 504	Rantoul Mun.
* 505	St. Joe Har.
* 506	St. Joe Mun.
* 507	Urbana Blacker
* 508	Urbana Mun.

* Indicates Facility In Us

It is apparent that there are a number of long haul distances, overlapping routes, especially from small communities. Haul problems may increase as small landfills are phased out. Areas for further work are: locating a new landfill; revising haul routes; and investigating the use of transfer stations.

Alternative 2: The Existing System (1974 Data)

The County's consultant projected major changes in the existing system which could take place in 1974. The existing system, as modified, consists of 57 sources and only 5 significant disposal sites. Until recently, most county waste was being taken to the Champaign (Site 501) and the Urbana (Site 508) municipal landfills. Restrictions imposed by these municipalities have caused the waste from rural areas to be directed elsewhere, probably to the St. Joe landfill (Site 505). As summarized on the diagram, the total system unit cost is $5.74/ton for haul and disposal. This is a reasonable cost, made possible by the fact that three large waste sources (Champaign with 1419 tons/week, Urbana with 715 tons/week, and the University of Illinois with 266 tons/week) are located near Sites 501 and 508. A serious problem which is not apparent in the total system cost is the cost of haul and disposal for the smaller communities such as Ivesdale (Source 143), Pesotum (Source 144), and Broadlands (Source 147). Their costs would be approximately $10.09/ton, $9.42/ton, and $11.02/ton respectively. Despite the reasonable overall cost of the existing system, it cannot continue because Sites 501 and 508 will be filled this year.

Champaign County

Existing System, (As Modified by 1974 Data)
Alternative 2

Key:

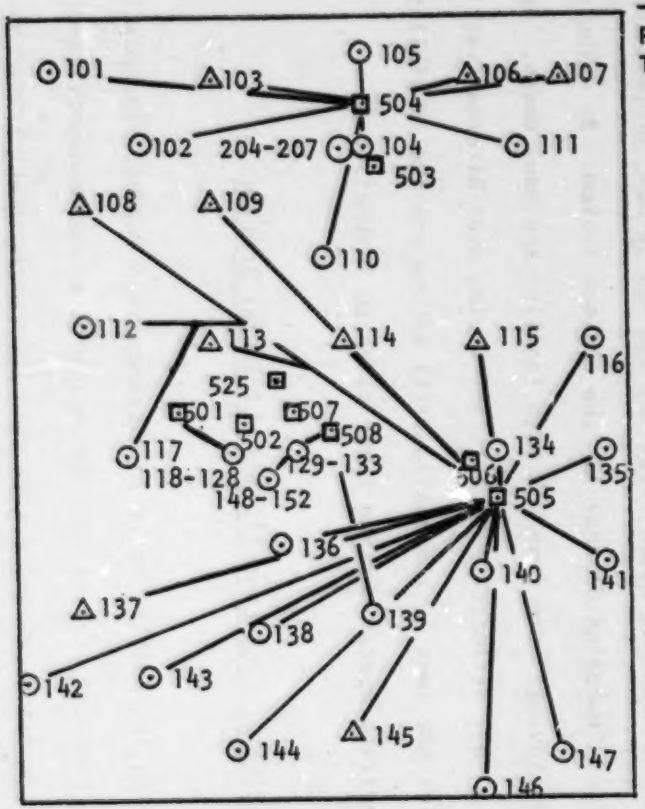
___ From Source to Ultimate

- - From Source to Intermediate

... From Intermediate to Ultimate

⊙ Sources

ID#	Name	T/W	ID#	Name	T/W
101	Foosland	17.	129	Urbana SE 8	143.
102	Fisher	23.	130	Urbana SE16	143.
103	East Bent T	56.	131	Urbana SE17	143.
104	Rantoul 36	106.	132	Urbana SE20	143.
105	Ludlow	22.	133	Urbana SE 7	143.
106	Harwood T	14.	134	St. Joseph	43.
107	Kerr T	10.	135	Ogden	29.
108	Newcombe T	14.	136	Savoy	11.
109	Conduit T	14.	137	Colfax T	14.
110	Thomasboro	11.	138	Tolono	46.
111	Gifford	32.	139	Philo	29.
112	Mahomet	42.	140	Sidney	29.
113	Hensley T	13.	141	Homer	35.
114	Somer T	13.	142	Ivesdale	19.
115	Stanton T	13.	143	Sadorus	5.
116	Royal	3.	144	Pesotum	21.
117	Bondville	14.	145	Crittenden T	15.
118	Champ SE 2	129.	146	Longview	18.
119	Champ SE 11	129.	147	Broadlands	15.
120	Champ SE 12	129.	148	U of I 1	53.
121	Champ SE 12	129.	149	U of I 2	53.
122	Champ SE 15	129.	150	U of I 3	53.
123	Champ SE 14	129.	151	U of I 4	53.
124	Champ SE 13	129.	152	U of I 5	54.
125	Champ SE 26	129.	204	Rantoul 35	106.
126	Champ SE 22	129.	205	Rantoul 34	156.
127	Champ SE 23	129.	206	Rantoul 1	146.
128	Champ SE 24	129.	207	Rantoul 2	56.



General Cost Analysis

Total Facility Annual Cost	$492,242
Total System Haul Cost	556,084
Total System Annual Cost	$1,048,326
Total System Annual Unit Cost	$5.74/ton
Tonnage Handled	3510

General Haul Cost Assumptions

Packer Haul Cost $4.36/ton-hr.
Transfer Haul Cost $1.40/ton-hr.

⊙ Intermediate Facilities

ID#	Name
701	Rantoul Transfer

⊡ Ultimate Facilities
Landfills

ID#	Name
*501	Champ/Mun.
502	Champ/Whit
?503	Chanute/A.F.B.
*504	Rantoul/Mun.
*505	St. Joe/Har.
*506	St. Joe/Mun.
507	Urbana/Blacker
*508	Urbana/Mun.
*525	New County Landfill

* Indicates Facility In Use

Alternative 3: Two Landfill Regional System

In this analysis, the model was asked to find an optimum number of landfills to serve the Region. A site (504) was specified for the Rantoul area. A choice of four sites (including 501) was offered for the Champaign-Urbana area. The model selected sites 504 and 525 (a new, proposed site located north of Champaign-Urbana) for the optimum system. By using only the two sites, savings were found in both facility and haul costs. The $5.13/ton unit cost reflected a significant saving over Alternatives 1 or 2. Benefits not seen in the two-landfill system are the possibilities for better facility operations and fewer sites to inspect.

Alternative 4: One Landfill and a Transfer Station

The saving in facility costs in Alternative 3 suggests the possibility of locating a transfer station near Rantoul with a single county landfill located near the principal waste sources. The one-landfill system would be a larger, more efficient operation with better environmental controls. On the other hand, the single-landfill system would lack the safety inherent in having an alternative site. The use of the transfer station instead of the Rantoul fill site decreased facility costs by approximately $9,000, but increased haul costs by approximately $75,000. The combined result was a $5.49/ton unit cost.

Champaign County
Two Landfill System

Alternative 3

Key:

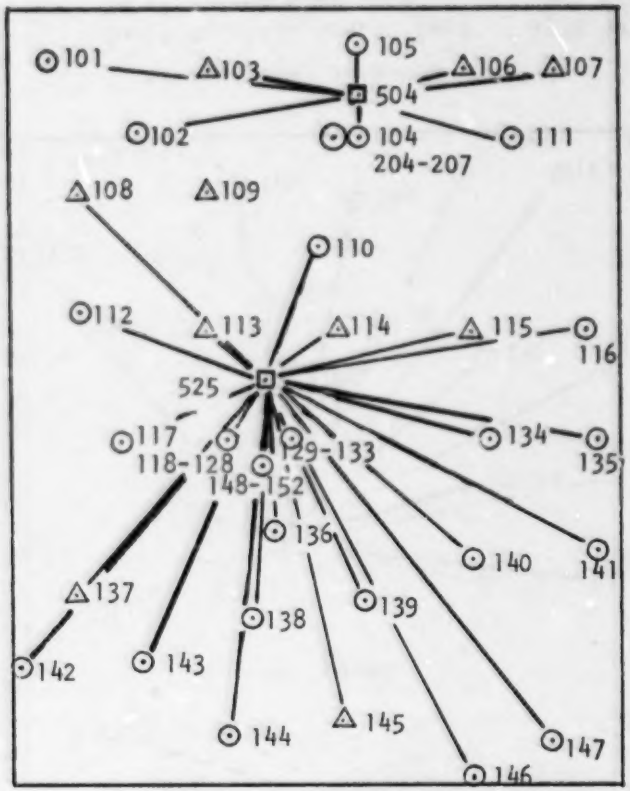
___ From Source to Ultimate

- - From Source to Intermediate

. . From Intermediate to Ultimate

⊙ Sources

ID#	Name	T/W	ID#	Name	T/W
101	Foosland	17.	129	Urbana SE 8	143.
102	Fisher	23.	130	Urbana SE16	143.
103	East Bent T	56.	131	Urbana SE17	143.
104	Rantoul 36	106.	132	Urbana SE20	143.
105	Ludlow	22.	133	Urbana SE 7	143.
106	Harwood T	14.	134	St. Joseph	43.
107	Kerr T	10.	135	Ogden	29.
108	Newcombe T	14.	136	Savoy	11.
109	Conduit T	14.	137	Colfax T	14.
110	Thomasboro	11.	138	Tolono	46.
111	Gifford	32.	139	Philo	29.
112	Mahomet	42.	140	Sidney	29.
113	Hensley T	13.	141	Homer	35.
114	Somer T	13.	142	Ivesdale	19.
115	Stanton T	13.	143	Sadorus	5.
116	Royal	3.	144	Pesotum	21.
117	Bondville	14.	145	Crittenden T	15.
118	Champ SE 2	129.	146	Longview	18.
119	Champ SE 11	129.	147	Broadlands	15.
120	Champ SE 12	129.	148	U of I 1	53.
121	Champ SE 12	129.	149	U of I 2	53.
122	Champ SE 15	129.	150	U of I 3	53.
123	Champ SE 14	129.	151	U of I 4	53.
124	Champ SE 13	129.	152	U of I 5	54.
125	Champ SE 26	129.	204	Rantoul 35	106.
126	Champ SE 22	129.	205	Rantoul 34	156.
127	Champ SE 23	129.	206	Rantoul 1	146.
128	Champ SE 24	129.	207	Rantoul 2	56.



General Cost Analysis

Total Facility Annual Cost	$338,200
Total System Haul Cost	597,620
Total System Annual Cost	$935,822
Total System Annual Unit Cost	$5.13/ton

⊙ Intermediate Facilities

ID#	Name
701	Rantoul Transfer

⊡ Ultimate Facilities
Landfills

ID#	Name
501	Champ/Mun.
502	Champ/Whit
503	Chanute/A.F.B.
*504	Rantoul/Mun.
505	St. Joe/Har.
506	St. Joe/Mun.
507	Urbana/Blacker
508	Urbana/Mun.
*525	New County Landfill

* Indicates Facility In Use

General Haul Cost Assumptions

Packer Haul Cost $4.36/ton-Hr.
Transfer Haul Cost $1.40/ton-hr

Champaign County
One Landfill Transfer Station System
Alternative 4

Key:

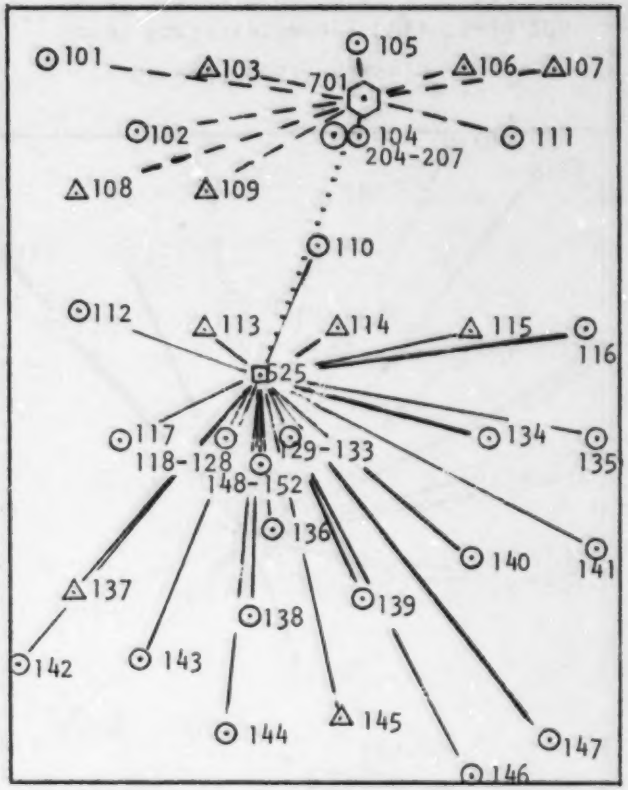
___ From Source to Ultimate

- - From Source to Intermediate

. . From Intermediate to Ultimate

⊙ Sources

ID#	Name	T/W	ID#	Name	T/W
101	Foosland	17.	129	Urbana SE 8	143.
102	Fisher	23.	130	Urbana SE16	143.
103	East Bent T	56.	131	Urbana SE17	143.
104	Rantoul 36	106.	132	Urbana SE20	143.
105	Ludlow	22.	133	Urbana SE 7	43.
106	Harwood T	14.	134	St. Joseph	29.
107	Kerr T	10.	135	Ogden	11.
108	Newcombe T	14.	136	Savoy	14.
109	Conduit T	14.	137	Colfax T	46.
110	Thomasboro	11.	138	Tolono	29.
111	Gifford	32.	139	Philo	29.
112	Mahomet	42.	140	Sidney	35.
113	Hensley T	13.	141	Homer	19.
114	Somer T	13.	142	Ivesdale	5.
115	Stanton T	13.	143	Sadorus	21.
116	Royal	3.	144	Pesotum	15.
117	Bondville	14.	145	Crittenden T	18.
118	Champ SE 2	129.	146	Longview	15.
119	Champ SE 11	129.	147	Broadlands	53.
120	Champ SE 12	129.	148	U of I 1	53.
121	Champ SE 12	129.	149	U of I 2	53.
122	Champ SE 15	129.	150	U of I 3	53.
123	Champ SE 14	129.	151	U of I 4	53.
124	Champ SE 13	129.	152	U of I 5	54.
125	Champ SE 26	129.	204	Rantoul 35	106.
126	Champ SE 22	129.	205	Rantoul 34	156.
127	Champ SE 23	129.	206	Rantoul 1	146.
128	Champ SE 24	129.	207	Rantoul 2	56.



General Cost Analysis

Total Facility Annual Cost	$328,997
Total System Haul Cost	672,638
Total System Annual Cost	$1,001,635
Total System Annual Unit Cost	$5.49/ton

General Haul Cost Assumptions

Packer Haul Cost $4.36/ton-hr.
Transfer Haul Cost $1.40/ton-hr

⊙ Intermediate Facilities

ID#	Name
* 701	Rantoul Transfer

⊡ Ultimate Facilities
Landfills

ID#	Name
501	Champ Mun.
502	Champ Whit
503	Chanute A.F.B.
504	Rantoul Mun.
505	St. Joe Har.
506	St. Joe Mun.
507	Urbana Blacker
508	Urbana Mun.
*525	New Fill

* Indicates Facility In Use

Alternative 5: One Landfill and no Transfer Station

To further investigate the one landfill solution, all waste was directed to the central site (525), this eliminating the transfer costs and reducing total facilities cost. As expected, the facilities cost decreased by $55,000 due to dropping the transfer station, but a $42,000 increase in haul cost somewhat offset the advantages of such a system. The $5.42/ton unit cost is not a significant change from the transfer alternative.

Alternative 6: Resource Recovery System (No Diagram)

The most likely place to build a resource recovery system would be near the twin-cities of Champaign and Urbana because: the principal waste loads are generated there; the cities are centrally located in the county; and the transportation network is excellent. There are a number of industries and the University of Illinois which could use the energy available from the combustible fraction of the processed waste.

This alternative considers the possibility of removing all of the regional waste to a central processing facility where metals, glass, and recyclable paper could be extracted for marketing. The remaining waste fraction would be available as a fuel with a value of approximately 50¢/million BTU's. A certain fraction of the waste would be unusable and would have to be taken to a sanitary landfill.

Champaign County

One Landfill and No Transfer Station

Alternative 5

Key:

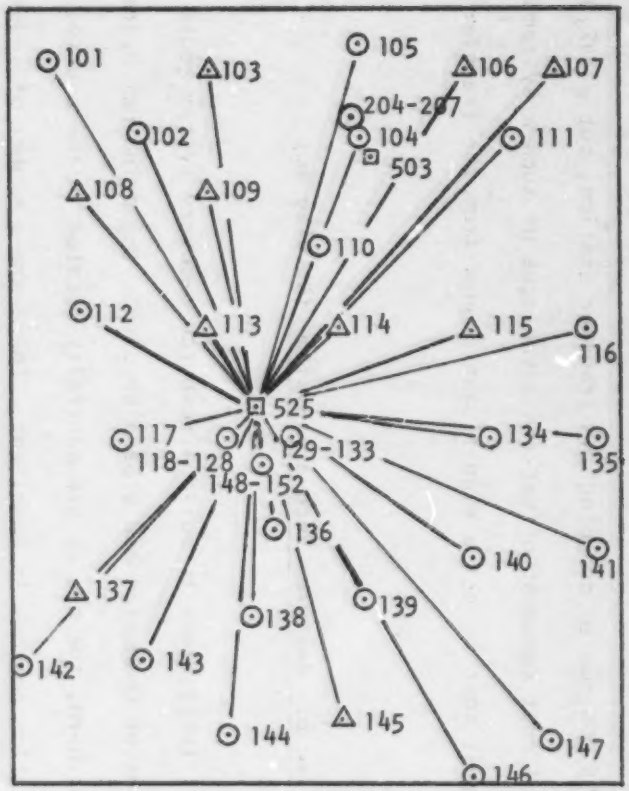
___ From Source to Ultimate

- - From Source to Intermediate

. . From Intermediate to Ultimate

⊙ Sources

ID#	Name	T/W	ID#	Name	T/W
101	Foosland	17.	129	Urbana SE 8	143.
102	Fisher	23.	130	Urbana SE16	143.
103	East Bent T	56.	131	Urbana SE17	143.
104	Rantoul 36	106.	132	Urbana SE20	143.
105	Ludlow	22.	133	Urbana SE 7	143.
106	Harwood T	14.	134	St. Joseph	43.
107	Kerr T	10.	135	Ogden	29.
108	Newcombe T	14.	136	Savoy	11.
109	Conduit T	14.	137	Colfax T	14.
110	Thomasboro	11.	138	Tolono	46.
111	Gifford	32.	139	Philo	29.
112	Mahomet	42.	140	Sidney	29.
113	Hensley T	13.	141	Homer	35.
114	Somer T	13.	142	Ivesdale	19.
115	Stanton T	13.	143	Sadorus	5.
116	Royal	3.	144	Pesotum	21.
117	Bondville	14.	145	Crittenden T	15.
118	Champ SE 2	129.	146	Longview	18.
119	Champ SE 11	129.	147	Broadlands	15.
120	Champ SE 12	129.	148	U of I 1	53.
121	Champ SE 12	129.	149	U of I 2	53.
122	Champ SE 15	129.	150	U of I 3	53.
123	Champ SE 14	129.	151	U of I 4	53.
124	Champ SE 13	129.	152	U of I 5	54.
125	Champ SE 26	129.	204	Rantoul 35	106.
126	Champ SE 22	129.	205	Rantoul 34	156.
127	Champ SE 23	129.	206	Rantoul 1	146.
128	Champ SE 24	129.	207	Rantoul 2	56.



General Cost Analysis

Total Facility Annual Cost	1,445,000
Total System Haul Cost	714,730
Total System Annual Cost	2,159,000
Total System Annual Unit Cost	$11.85/ton

General Haul Cost Assumptions

Packer Haul Cost $4.36/ton--hr.
Transfer Haul Cost $1.40/ton-hr.

⊙ Intermediate Facilities

ID#	Name

⊡ Ultimate Facilities
Landfills

ID#	Name
501	Champ Mun.
502	Champ Whit
503	Chanute A.F.B.
504	Rantoul Mun.
505	St. Joe Har.
506	St. Joe Mun.
507	Urbana Blacker
508	Urbana Mun.
* 525	New Fill

* Indicates Facility in Use

At present levels of operation (3510 tons/week), the annual haul cost would be $714,730/year. The landfill cost (assuming 25% residue) would add $105,000/year.

A resource power recovery incinerator (see Table B-10, Appendix B) might cost $1,600,000/year (recent information suggests that this cost may have doubled). The total system would cost $2,429,000/year or approximately $13.25/ton.

Off-setting values of recovered materials are suggested in Table 10, Chapter 1. Present indications for Illinois, however, suggest revenue possiblities of $3.50/input-ton for fuel and 50¢/input-ton for metals. Obviously, $4.00/ton is not enough to justify the $13.25/ton system cost (as compared with landfilling at $5.13/ton).

By 1990, however, regional waste quantities will have increased to 5870 tons/week. At this level of operation, the unit cost would be approximately $11.40/ton. From these calculations, it is evident that the key to resource recovery is an improvement in the markets for energy and secondary materials to a level of $7-8/ton.

Summary

The least-costly alternative for Champaign County is a two-landfill system. The new Site (525) should have approximately 330 acres (assuming a 20-foot fill and 1000#/cu. yd. compaction) to accomodate the quantities

expected through the year 1990.

The county has sufficient waste to meet the 3500 tons/week minimum specified by some as the threshold for resource recovery systems. However, markets for recovered materials do not presently justify the large capital expenditure ($4-6 million) and the relatively high system unit cost. If the value of recovered resources rises to a level of $7-8/ton, the resource recovery system can probably be justified. If it can be assumed that a resource recovery system will be operating in 1980, the total land requirement is reduced to approximately 163 acres.

The Rural Waste Problem

The remaining problem for the region is the management cost for rural waste sources. It is possible that many rural residents have no solid waste collection, haul, and disposal service. They will not be easily convinced of the need for a better-managed system. They must be persuaded that, directly or indirectly, they are paying for solid waste management.

One approach to this problem is to evaluate the hidden and indirect costs of inadequate solid waste management practices. The convenience and the saving in time and transportation costs for self-hauling to the traditional disposal site are obvious, and will become more evident when many of the small landfills close in response to State environmental regulations.

A more pertinent argument is the cost to the rural landowner of the promiscuous dumping that takes place on his land or along the road which serve his property. The aggravation, the possible land devaluation, and the legal liabilities of having an open dump on his property are real costs to a landowner. The road maintenance funds spent on trash pick-up have been estimated by one study at $50 per ton. The diversion of road funds can only result in less road maintenance, a further cost and inconvenience to the rural landowners. In any case, part of the rural property tax dollar will be used for the solid waste disposal.

Neighboring Coles County has an excellent container system which sets up monthly collection sites in eight rural locations. The cost of the system (about $10,000/year) is reasonable considering the serious need and the excellent results achieved.

Use of this Study

This study is intended for the regional planning officials whose job is to work with local elected officials to find ways to meet local needs. The alternatives show the comparative economics of several management systems. Much of this information is subject to change. Planners and engineers who have need to modify or up-date these alternatives may obtain assistance from the Illinois Institute for Environmental Quality.

APPENDIX A

Champaign County Information

		Page
1	Geological Information	A-1
2	Population Projections - Table 1	A-2
3	Employment Projections - Table 2	A-3
4	Total Solid Waste Quantities - Table 3	A-5

CHAMPAIGN

Typed Bedrock: Mainly shale with some fractured sandstone and limestone, small areas of fractured limestone and sandstone with dolomite.

Drift Thickness: Drift over 200 ft. deep in most sections with eastern part 50 - 200 ft.

Type of Drift Material: Till covered by 4 ft. loess.

Glacial Aquifers: Present.

Sand and Gravel Aquifers: Extensive-northern half, scattered-southern portion.

Limestone Aquifers: Present only in southwest corner of county.

Sandstone Aquifers: Present through-out with exception of limestone area.

The bedrock consists mainly of shale with some permeable sandstone and limestone in most areas. One area in the west central portion, another area to the east central and a third to the southwest appear to have only fractured limestone, sandstone, and some dolomite. The Mahomet buried bedrock valley can be found crossing this county. The drift on the east-central portion is found to be 50-200 ft. thick, while the excluded portions have more than a 200 ft. layer of drift. Till drift with a 4 ft. loess cover are found throughout the county. The bedrock valley contains many sand and gravel aquifers with sandstone aquifer found in most other areas. Some limestone aquifers can be found in the south western region.

Potential bedrock contamination through-out the county is very low as well as for the unconsolidated aquifers. Only the north western portion is subject to unconsolidated potential contamination. Natural protection of the ground water appears to be available throughout the county.

TABLE 1

PROJECTED POPULATION FOR CHAMPAIGN COUNTY

	1970	1975	1980	1985	1990	1995	2000
Broadlands	320	310	300	300	300	300	300
Champaign	56,800	59,800	62,800	68,550	74,300	79,400	84,500
Fisher	1,530	1,625	1,720	1,875	2,030	2,180	2,330
Foosland	170	180	190	205	220	235	250
Gifford	810	915	1,020	1,155	1,290	1,425	1,560
Homer	1,350	1,410	1,470	1,550	1,630	1,705	1,780
Longview	220	205	190	175	160	145	130
Ludlow	530	570	610	750	890	995	1,100
Mahomet	1,300	1,385	1,470	1,635	1,800	1,950	2,100
Ogden	700	780	860	985	1,110	1,230	1,350
Pesotum	540	585	630	690	750	810	870
Philo	1,020	1,125	1,230	1,415	1,600	1,790	1,980
Rantoul	25,600	26,650	27,700	29,550	31,400	33,050	34,700
Royal	200	205	210	220	230	240	250
Sadorus	450	505	560	620	680	745	810
Savoy	590	790	990	1,225	1,460	1,720	1,980
Sidney	920	1,030	1,140	1,270	1,400	1,520	1,640
St. Joseph	1,550	1,675	1,800	2,015	2,230	2,425	2,620
Thomasboro	810	935	1,060	1,215	1,370	1,500	1,630
Tolono	2,030	2,185	2,340	2,630	2,920	3,240	3,560
Urbana	33,700	35,900	38,100	42,300	46,500	50,200	53,900
Ivesdale	350	360	370	385	400	415	430
Incorporated	131,490	139,125	146,760	160,715	174,670	187,220	199,770
Unincorporated	31,810	31,725	31,640	32,885	34,130	34,530	34,930
County Total	163,300	170,850	178,400	193,600	208,800	221,750	234,700

TABLE 2

PROJECTED EMPLOYMENT FOR CHAMPAIGN COUNTY

	SIC	1971	1975	1980	1985	1990	1995	2000
Champaign								
	202	300	300	300	300	300	300	300
	203	599	2000	2000	2000	2000	2000	2000
	204	20	20	20	20	20	20	20
	205	216	201	185	170	154	139	123
	208	132	108	83	58	33	8	-
	209	497	497	497	497	497	497	497
	238	478	443	408	373	338	303	268
	239	3	5	7	7	10	11	11
	251	25	36	46	52	59	65	69
	253	100	110	110	100	100	110	100
	259	1	1	0	2	1	2	1
	271	409	409	409	409	409	409	409
	275	212	214	216	218	220	222	225
	279	25	25	22	21	20	18	17
	287	3	2	2	2	2	1	1
	295	90	90	90	90	90	90	90
	307	17	17	17	17	17	17	17
	3272	45	45	45	45	45	45	45
	327	39	26	22	18	15	13	11
	336	225	200	200	210	220	230	230
	339	300	260	230	230	210	190	180
	344	150	200	290	370	440	500	570
	346	50	55	61	67	72	76	78
	353	270	230	220	190	190	160	160
	358	80	110	150	200	230	270	300
	359	26	29	30	32	33	32	34
	365	5	8	11	13	15	18	20
	372	35	63	83	99	110	130	140
	379	4	7	8	11	13	14	16
	382	15	8	4	2	0	0	0
	399	9	7	9	10	12	12	13
Fisher								
	275	1	0	0	0	0	0	0
	352	24	8	3	1	0	0	0
Homer								
	201	12	14	16	17	20	21	22
	307	13	12	18	22	27	30	33
Mahomet								
	261	14	25	33	40	47	52	57
	275	5	2	1	1	0	0	0
Ogden								
	287	6	6	6	6	6	7	7

TABLE 2

PROJECTED EMPLOYMENT FOR CHAMPAIGN COUNTY (Continued)

Rantoul	SIC	1971	1975	1980	1985	1990	1995	2000
	243	-	250	250	270	300	330	350
	271	41	40	49	56	63	65	71
	3272	10	8	9	11	13	13	14
	347	3	2	2	2	2	2	1
	359	1	1	2	3	3	3	3
St. Joseph								
	204	16	20	11	6	2	0	0
	209	80	120	180	230	270	310	340
	275	8	7	6	5	5	4	4
Tolono								
	307	33	44	55	66	77	88	94
Urbana								
	232	50	37	22	13	7	4	2
	251	3	2	3	4	4	5	5
	265	0	300	325	350	375	400	400
	275	19	11	10	9	7	6	6
	283	18	16	14	13	13	12	11
	3272	20	20	20	20	20	20	20
	327	19	17	16	13	11	9	7
	328	15	15	14	12	12	11	10
	336	1	1	2	3	3	4	4
	344	15	15	15	15	15	15	15
	359	27	39	47	56	62	64	71
	366	530	0	0	0	0	0	0
	371	40	0	0	0	0	0	0
	386	10	0	0	0	0	0	0
	394	90	101	112	123	134	145	156
	399	18	16	14	13	13	12	11

Table 3

Solid Waste Quantities by Source

Champaign County

Source Name	Source I.D.#	1973 Values Quantity (Tons/week)	1990 Value Quantity (Tons/week)	Source Name	Source I.D.#	1973 Values Quantity (Tons/week)	1990 Value Quantity (Tons/week)
Foosland	101	17	20	Urbana Sec 17	131	143	206
Fisher	102	23	48	Urbana Sec 20	132	143	206
East Bend T	103	14	15	Urbana Sec 21	133	143	206
Rantoul	104	106	111	St.Joseph	134	43	80
Ludlow	105	22	36	Ogden	135	29	50
Harwood T	106	14	14	Savoy	136	11	38
Kerr	107	10	14	Colfax T	137	15	19
Newcombe T	108	14	15	Tolono	138	46	92
Condit T	109	14	15	Philo	139	30	57
Thomasboro	110	11	30	Sidney	140	29	55
Gifford	111	32	59	Homes	141	35	60
Mahomet	112	42	92	Ivesdale	142	19	28
Hensley T	113	13	18	Sadorus	143	5	13
Somer T	114	13	18	Pesotum	144	21	34
Stanton T	115	13	18	Crittendem T	145	15	19
Royal	116	3	6	Longview	146	18	23
Bondville	117	14	32	Broadlands	147	15	20
Champaign Sec 2	118	129	218	U of I 1	148	53	77
Champaign Sec 11	119	129	218	U of I 2	149	53	77
Champaign Sec 12	120	129	218	U of I 3	150	53	77
Champaign Sec 12.5	121	129	218	U of I 4	151	54	77
Champaign Sec 15	122	129	218	U of I 5	152	54	77
Champaign Sec 14	123	129	218	Rantoul 1	204	106	210
Champaign Sec 13	124	129	218	Rantoul 2	205	156	309
Champaign Sec 12.7	125	129	218	Rantoul 3	206	107	289
Champaign Sec 22	126	129	218	Rantoul 4	207	106	111.3
Champaign Sec 23	127	129	218				
Champaign Sec 24	128	129	218				
Urbana Sec 8	129	143	206				
Urbana Sec 16	130	143	206				

APPENDIX B

	Pages
1. Method for calculating municipal and industrial collection rates.	B-1
2. Industrial waste generation factors. Table B-1	B-3
3. Haul Cost Factor with assumptions. Table B-2	B-6
4. Cost Functions: Sanitary Landfill. Figure B-1	B-9
5. Basic Landfill Cost Assumptions For 50, 100, 250, 500, 1000, 2000, and 5000 tons/week. Tables B-3 to B-9	B-10
6. Cost Functions: Intermediate Processing Facilities. Figure B-2	B-18
7. Equations for Facility Cost Functions.	B-19
8. Resource Recovery Facility Description.	B-21
9. Resource Recovery Capital and Annual Cost. Table B-10	B-22

Municipal Generation Rates

The technique selected for estimating present generation rates was developed by Roy F. Weston, Inc. The technique involved the calculation of a generation rate factor which was then multiplied by the population to obtain the generation rate per week for a given geographic area. The generation factor is a function of the population density as shown in the following equations:

$$U = 1.54 \text{ Log } D - 0.68$$

$$V = U \times 7 \text{ day/week} \times 1 \text{ ton/2000 lbs.}$$

$$W = V \times \text{Population within the given area}$$

where: U = per capita waste generation rate in lbs/capita /day

D = population density in person/square miles

V = per capita waste generation rate in tons/capita/week

W = ton per week of waste generated within given area

This relationship is valid in the population density range of 500 - 12,000 persons/square mile. Below the lower limit of the range, the generation factor used is 3.4 lbs/capita/day; above the upper limit, the factor used is 5.6 lbs/capita/day.

Industrial Generation Rate

During the past few years, the Office of Solid Waste Management Programs has funded a number of industrial solid waste surveys to develop solid waste generation factors. A summary of these factors was used to develop industrial solid waste loads by SIC number. The following equation demonstrates the use of the generation factors.

I = G.F. x No. of Employees

J = I÷ 52

where I = yearly production rate in tons/year

G. F = generation factor in tons/employee/year

J = weekly production rate in tons/week

These relationships are used to estimate probable industrial waste loads, but the yearly employment fluctuation, and generation factors make adjustment necessary for specific locations and plants.

TABLE B-1

Industrial Solid Waste Generation Factors [8]

SIC No.	Name	Generation Factor (tons/employee/year)
201	Meat Products	14.1
2021	Creamery butter	33.0
2022	Cheese, Natural and Processed	169.1
202 (R)[1]	Dairy Products	2.2
203	Canned and Preserved Fruits, Vegetables and Sea Foods	5.4
204	Grain Mill Products	6.2
205	Bakery Products	1.2
206	Sugar	17.2
207	Confectionery and Related Products	3.3
208	Beverages	11.0
209	Miscellaneous Food Preparations and Kindred Products	0.8
211	Cigarettes	1.5
212	Cigars	3.1
213	Tobacco (Chewing and Smoking) and Snuff	0.2
214	Tobacco Stemming and Redrying	4.4
221	Broad Woven Fabric Mills, Cotton	0.4
222	Broad Woven Fabric Mills, Man-made Fiber and Silk	0.7
223	Broad Woven Fabric Mills	0.1
224	Narrow Fabrics and Other Small-wares Mills: Cotton, Wool, Silk and Man-made Fiber	1.2
225	Knitting Mills	1.3
226	Dyeing and Finishing Textiles, Except Wood Fabrics and Knit Goods	2.4
227	Floor Covering Mills	0.2
228	Yarn and Thread Mills	0.7
229	Miscellaneous Textile Goods	4.5
231	Men's, Youths', and Boys' Suits, Coats and Overcoats	0.3
232	Men's, Youths', and Boys' Furnishings, Work Clothing, and Allied Garments	0.3
233	Women's, Misses', and Juniors' Outerwear	0.9
234	Women's, Misses', Children's and Infants' Under Garments	0.4
235	Hats, Caps, and Millinery	0.2
236	Girls', Children's, and Infants' Outerwear	0.9
237	Fur Goods	0.5
238	Miscellaneous Apparel and Accessories	0.4
239	Miscellaneous-Fabricated Textile Products	0.4
241	Logging Camps and Logging Contractors	30.0
2421	Sawmills and planing mills, general	420.0
242 (R)[1]	Sawmills and planing mills	38.7
2432	Veneer and plywood	232.0
243 (R)[1]	Millwork, Veneer, Plywood, and Prefabricated Structural Wood Products	21.7
244	Wooden Containers	16.0
249	Miscellaneous Wood Products	43.0
251	Household Furniture	1.8
252	Office Furniture	2.6
253	Public Building and Related Furniture	1.8
254	Partitions, Shelving, Lockers, and Office and Store Fixtures	3.6
259	Miscellaneous Furniture and Fixtures	1.5
261	Pulp Mills	31.5
262	Paper Mills, Except Building Paper Mills	11.7
263	Paperboard Mills	11.5
264	Converted Paper and Paperboard Products, Except Containers and Boxes	4.0
265	Paperboard Containers and Boxes	12.6
266	Building Paper and Building Board Mills	103.0
271	Newspapers: Publishing, Publishing and Printing	1.1
272	Periodicals: Publishing, Publishing and Printing	0.1
273	Books	0.8
274	Miscellaneous Publishing	0.1
275	Commercial Printing	1.1
276	Manifold Business Forms	4.4
277	Greeting Card Publishing	1.2
278	Blankbooks, Loose Leaf Binders, and Bookbinding and Related Work	2.6
279	Service Industries for Printing Trade	1.4
2819	Industrial Inorganic Chemicals, not Elsewhere Classified	109.0
281 (R)[1]	Industrial Inorganic and Organic Chemicals	18.8
282	Plastics Materials and Synthetic Resins, Synthetic Rubber, Synthetic and Other Man-Made Fibers, Except Glass	16.2

TABLE B-1

Industrial Waste Generation Factors (Continued)

SIC No.	Name	Generation Factor (tons/employee/year)
283	Drugs	3.4
284	Soap, Detergents, and Cleaning Preparations, Perfumes, Cosmetics, and Other Toilet Preparations	3.3
285	Paints, Varnishes, Lacquers, Enamels, and Allied Products	6.2
286	Gum and Wood Chemicals	0.1
287	Agricultural Chemicals	13.5
2891	Adhesives and gelatin	39.4
289 (R)[1]	Miscellaneous Chemical Products	1.2
291	Petroleum Refining	30.6
295	Paving and Roofing Materials	0.9
299	Miscellaneous Products of Petroleum and Coal	9.3
301	Tires and Inner Tubes	3.7
302	Rubber Footwear	2.1
303	Reclaimed Rubber	2.4
306	Fabricated Rubber Products, Not Classified Elsewhere	2.5
307	Miscellaneous Plastics Products	1.3
311	Leather Tanning and Finishing	2.3
312	Industrial Leather Belting and Packing	0.8
313	Boot and Shoe Cut Stock and Findings	1.8
314	Footwear, Except Rubber	0.4
315	Leather Gloves and Mittens	1.3
316	Luggage	7.0
317	Handbags and Other Personal Leather Goods	0.4
319	Leather Goods, Not Elsewhere Classified	0.5
321	Flat Glass	2.5
322	Glass and Glassware, Pressed or Blown	1.4
323	Glass Products, Made of Purchased Glass	1.8
324	Cement, Hydraulic	8.8
325	Structural Clay Products	1.7
326	Pottery and Related Products	3.6
3272	Concrete products, except block and brick	154.0
327 (R)[1]	Concrete, Gypsum, and Plaster Products	15.0
328	Cut Stone and Stone Products	4.2
329	Abrasive, Asbestos, and Miscellaneous Nonmetallic Mineral Products	5.2
3312	Blast Furnaces (including coke ovens), Steel Works, and Rolling Mills	130.0
331 (R)[1]	Blast furnaces, Steel Works, and Rolling and Finishing Mills	3.4
3321	Gray Iron foundries	100.0
332 (R)[1]	Iron and Steel Foundries	20.0
3334	Primary production of aluminum	58.0
333 (R)[1]	Primary Smelting and Refining of Nonferrous Metals	2.5
334	Secondary Smelting and Refining of Nonferrous Metals	103.0
335	Rolling, Drawing and Extruding of Nonferrous Metals	5.3
336	Nonferrous Foundries	2.7
339	Miscellaneous Primary Metal Products	2.0
341	Metal Cans	11.2
342	Cutlery, Hand Tools, and General Hardware	2.8
343	Heating Apparatus (Except Electric) and Plumbing Fixtures	7.3
344	Fabricated Structural Metal Products	2.8
345	Screw Machine Products, and Bolts, Nuts, Screws, Rivets and Washers	2.9
346	Metal Stampings	6.2
347	Coating, Engraving and Allied Services	1.5
348	Miscellaneous Fabricated Wire Products	3.1
3491	Metal Shipping Barrels, Drums, Kegs and Nails	13.7
349	Miscellaneous Fabricated Metal Products	1.4
351	Engines and Turbines	1.5
352	Farm Machinery and Equipment	0.9
353	Construction, Mining, and Materials Handling Machinery and Equipment	2.2
354	Metalworking Machinery and Equipment	2.9
355	Special Industry Machinery, Except Metalworking Machinery	0.7
356	General Industrial Machinery and Equipment	1.3
357	Office, Computing, and Accounting Machines	0.8
358	Service Industry Machines	1.5
359	Miscellaneous Machinery, Except Electrical	1.4
361	Electric Transmission and Distribution Equipment	0.8
362	Electrical Industrial Apparatus	0.7
363	Household Appliances	2.4
364	Electric Lighting and Wiring Equipment	2.2
365	Radio and Television Receiving Sets, Except Communication Types	0.8

TABLE B-1

Industrial Waste Generation Factors (Continued)

SIC No.	Name	Generation Factor (tons/employee/year)
366	Communication Equipment	1.9
367	Electronic Components and Accessories	1.0
369	Miscellaneous Electrical Machinery Equipment, and Supplies	2.8
371	Motor Vehicles and Motor Vehicle Equipment	2.4
372	Aircraft and Parts	1.2
3731	Ship Building and Repairing	37.0
3732	Boat Building and Repairing	4.1
374	Railroad Equipment	6.2
375	Motorcycles, Bicycles, and Parts	2.9
379	Miscellaneous Transportation Equipment	1.7
381	Engineering, Laboratory, and Scientific and Research Instruments and Associated Equipment	1.1
382	Instruments for Measuring, Controlling, and Indicating Physical Characteristics	0.4
383	Optical Instruments and Lenses	0.5
384	Surgical, Medical, and Dental Instruments and Supplies	2.3
385	Ophthalmic Goods	2.6
386	Photographic Equipment and Supplies	0.4
387	Watches, Clocks, Clockwork Operated Devices, and Parts	0.6
391	Jewelry, Silverware, and Plated Ware	0.8
393	Musical Instruments	0.6
394	Toys, Amusement, Sporting and Athletic Goods	1.7
395	Pens, Pencils, and Other Office and Artists' Materials	0.5
396	Costume Jewelry, Costume Novelties, Buttons, and Miscellaneous Notions, Except Precious Metal	0.3
399	Miscellaneous Manufacturing Industries	2.0

1) Includes the waste in the remainder of the 4-digit codes under this 3-digit code.

TABLE B-2

HAUL COST FACTORS

Type of Truck	Capacity, yd^3	Compacted Density lbs/yd^3	Cost of Truck($)	Life of Truck(yr)	Daily Operating Cost ($)	No. In Crew		Wages, $/hr.[3]				Work-Day (Hrs.)	Work-Week (Days)	Haul Cost($/ton-hr.)	
								Chicago		Downstate					
						Driver	Laborer	Driver	Laborer	Driver	Laborer			Chicago	Downstate
Rear Loading Compactor	16	500	17,175	5	40	1	1	7.19	6.56	5.70	5.10	8	5	5.10	4.36
Rear Loading Compactor (Municipal	25	500	20,772	5	35	1	2	7.19	6.56	5.70	5.10	8	5	4.28	3.66
Rear Loading Compactor (Private)	25	800	30,444	5	35	1	2	7.19	6.56	5.70	5.10	8	5	2.76	2.32
Front Loading Compactor	30	800	42,875	5	40	1	0	7.19	-	5.70	-	8	5	1.35	1.23
Tilt Frame & 13 Containers	42	500	42,325[1]	5	35	1	0	7.19	-	5.70	-	8	5	1.98	1.75
Tractor & 2 Transfer Trailers	75	500	75,800[2]	5	52	1	0	7.19	-	5.70	-	8	6	1.10	1.00*

(1) Includes the cost of the 13 containers.
(2) Includes the cost of the 2 transfer trailers.
(3) Includes fringe benefits.
* $1.40/Ton-Hr. For Vehicles operated 6 hours per day

ASSUMPTIONS FOR HAUL COST CALCULATIONS

Chicago Area

Assumptions:

1. 45% residential, 30% industrial, & 25% commercial solid waste.
2. 50% private and 50% public collection in the residential sector.
3. Only private collection in the industrial and commercial sectors.
4. 24 yd^3 compactor trucks used for residential collection.
5. Tilt-frame trucks used for industrial collection.
6. 30 yd^3 front loading compactor trucks used for commercial collection.
7. 5 loads/day by tilt-frame trucks.
8. 3 loads/day by front loading compactor trucks.

Haul Costs:

1. From collection route to intermediate facility or disposal site, collection vehicles operate 8 hours per day.
2. From intermediate facility to disposal site, vehicles operate 8 hours per day - $1.10/ton-hr.

Downstate

Assumptions:

1. 75% residential, 15% industrial, and 10% commercial solid waste.
2. 50% private and 50% public collection in the residential sector.
3. Only private collection in the industrial and commercial sectors.
4. 25 yd^3 compactor trucks used for residential collection.

5. Tilt-frame trucks used for industrial collection.

6. 30 yd^3 front loading compactor trucks used for commercial collection.

7. 5 loads/day by tilt-frame trucks.

8. 3 loads/day by front loading compactor trucks.

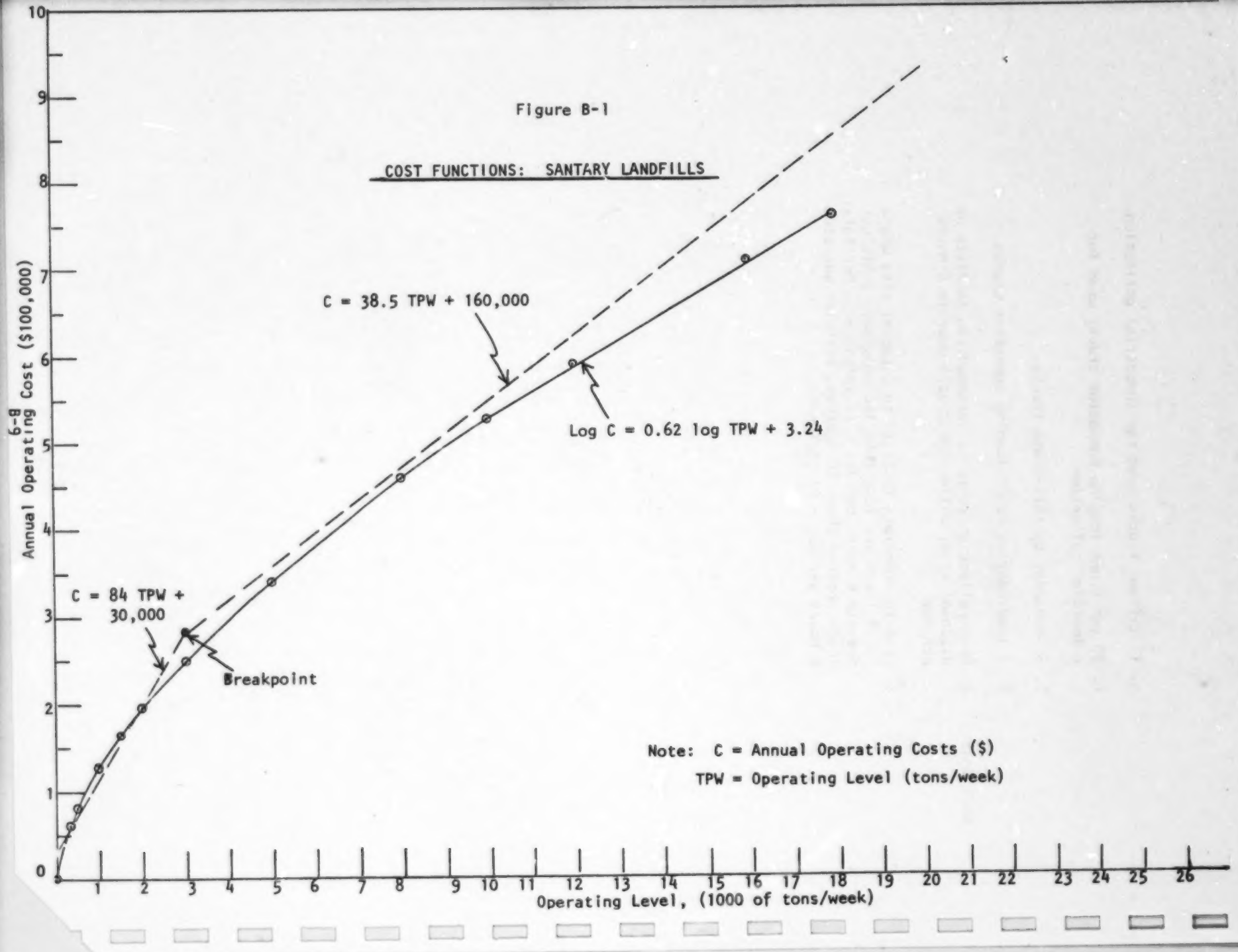
Haul Costs:

1. From collection route to intermediate facility or disposal site, collection trucks operate 8 hours per day.

2. From intermediate facility to disposal site where total loads are less than 150 tons/day, vehicles operate 6 hours per day - $1.40/ton-hr. For total loads greater than 150 ton/day, vehicles operate 8 hours per day - $1.00/ton-hr.

Figure B-1

COST FUNCTIONS: SANTARY LANDFILLS


Annual Operating Cost ($100,000)
C = 38.5 TPW + 160,000
Log C = 0.62 log TPW + 3.24
C = 84 TPW + 30,000
Breakpoint
Note: C = Annual Operating Costs ($)
TPW = Operating Level (tons/week)
Operating Level, (1000 of tons/week)

BASIC LANDFILL COST ASSUMPTIONS

TABLE B-3
ASSUMING EXCAVATION DONE BY RENTED OR LEASED UNIT

50 TPW

EQUIPMENT TABLE A

	CAPITAL COST		OWNING		O&M
Farm Tractor & Loader or Blade	$15,000	@ 22%	$3,600	@24%	$3,300
Fuel	500		119		50
	$15,500		$3,719		$3,350

PERSONNEL COST-TABLE B

Supervisor & Operator @ $11.50/Hr. and fringe for 2 days a week - $184./Wk.
$9568./Per Year

FACILITY COST ESTIMATE- TABLE C

		Yr.	CC	@%	AC
1.	Design	25	$ 9,000	8	720
2.	Preparation	25	12,000	8	840
3.	Building Facilities	25	1,000	8	80
4.	Equipment	varies	$15,500		3,719
	Sub-Total		$37,500		
5.	Supervision & Inspection	25	2,510	8	201
	Sub-Total		$40,010		
6.	Contingency 10%	25	4,001	8	320
	Sub-Total		$44,011		
7.	Legal 3%	25	1,320		106
	Sub-Total		$45,331		
8.	Bond Discount 3%	25	1,360		109
	TOTAL CAPITAL COST		$46,691		6095.

ANNUAL COST	
A. Sum of 1-8	$6,095
B. Equipment	3,350
Facility 50% of CC-3	500
Miscellaneous 3% of CC-2	360
C. Salaries	9,568
Overhead	
Total Annual Cost	$19,873
Annual Cost/Ton	$ 7.64
@ 52 Weeks	
@ 50 TPW	

O&M- OPERATION AND MAINTENANCE
Yr.- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-4

BASIC LANDFILL COST FUNCTION ASSUMPTIONS

100 TPW

EQUIPMENT TABLE A

	CAPITAL COST	OWNING		O&M	
Tractor & Loader or Blade	$15,000	24%	$3,600	30%	$4,500
Fuel	500		119		50
	$15,500		$3,719		$4,550

PERSONNEL COST TABLE B

Supervisor and Operator @ $11.50/Hr. include Fringe for 4 days a week - $19,136

FACILITY COST ESTIMATE TABLE C

		YR	CC	@%	AC
1.	Design	25	$10,000	8	$ 800
2.	Preparation	25	13,000	8	1,040
3.	Building Facilities	25	1,000	8	80
4.	Equipment	varies	15,500		3,719
	Sub-Total		$39,500		
5.	Supervision & Inspection	25	3,020		242
	Sub-Total		$42,520		
6.	Contingency - 10%	25	4,252		340
	Sub-Total		$46,772		
7.	Legal 3%	25	1,403		112
	Sub-Total		$48,175		
8.	Bond Discount 3%	25	1,445		116
	TOTAL CAPITAL COST		$49,620		$6,449

ANNUAL COST	
A. Sum of 1-8	$ 6,449
B. Equipment	$ 4,550
Facility 50% of CC-3	500
Miscellaneous 3% of EC-2	390
C. Salaries	$19,136
Total Annual Cost	$30,975
Annual Cost/Ton @ 52 Weeks @ 100 Tons	$5.96

O&M- OPERTION AND MAINTENANCE
Yr.- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-5

BASIC LANDFILL COST ASSUMPTIONS

250 TPW

EQUIPMENT TABLE A

	YEAR	CAPITAL COST	%	OWNING	%	O & M
Crawler	5	$36,000	24	$8,546	22	$8,000
Fuel	5	500	24	119		50
		$36,500		$8,665		$8,050

PERSONNEL COST TABLE B

		ANNUAL
1 Laborer $4/Hr.- 2080	Fringes	$8,320
1 Operator & Supervisor $11.50/Hr - 2080	"	24,000
		$32,320

FACILITY COST ESTIMATE TABLE C

		Yr.	CC	@%	AC
1.	Design	25	$11,000	8	$ 880
2.	Preparation	25	14,000	8	1,120
3.	Building Facilities	25	1,000	8	80
4.	Equipment	varies	36,500		8,665
	Sub-Total		$62,500		
5.	Supervision & Inspection 2% of 4	25	3,330	8	266
	Sub-Total 10% of 1-3		$65,830		
6.	Contingency 10%	25	6,583	8	527
	Sub-Total		$72,413		
7.	Legal 3%	25	2,172	8	174
	Sub-Total		$74,585		
8.	Bond 3%	25	2,238	8	179
	TOTAL CAPITAL COST		$76,823		$11,891

ANNUAL COST		
A.	Lines 1-8	$11,891
B.	Equipment	8,050
	Facility 50% of CC-3	500
	Miscellaneous 3% of CC-2	420
C.	Salaries	$32,320
	Total Annual Cost	$53,181
	Annual Cost/Unit	$ 4.13/Ton

O&M- OPERATION AND MANTENANCE
Yr.- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-6

BASIC LANDFILL COST ASSUMPTIONS

500 TPW

EQUIPMENT - TABLE A

	YEAR	CAPITAL COST	%	OWNING	%	O&M
Crawler 195Hp	5	$58,000	24	$13,779	24	$13,800
Fuel	5	800		190		100
Scales	10	$ 7,500	14	1,019	8	600
		$66,300		$14,988		$14,500

LABOR TABLE B

Supervisor Scale Man $4/Hr. $5/Hr.	$11,000
Operator @ $11.50 for 2080 Hr.	24,000
Laborer $4.00/Hr. for 2080 Hr.	8,320
	$4 ,320

FACILITY COST ESTIMATE TABLE C

		YR.	CC	@%	AC
1.	Design	25	$15,000	8	$ 1,173
2.	Preparation	25	20,000	8	1,565
3.	Building Facilities	25	8,000	8	640
4.	Equipment	Varies	66,300		14,988
	Sub-Total		$109,300		
5.	Supervision & Inspection	25	5,626	8	450
	Sub-Total		$114,926		
6.	Contingency 10%	25	11,493	8	919
	Sub-Total		$126,419		
7.	Legal 3%	25	3,793	8	303
	Sub-Total		$130,212		
8.	Bond Discount 3%	25	3,906	8	312
	TOTAL CAPITAL COST		$134,118		$20,350

ANNUAL COST

A.	Line 1-8	$20,350
B.	Equipment	14,500
	Facility ≈50% of CC-3	3,500
	Miscellaneous 3% of CC-2	600
C.	Salaries	43.320
	Total Annual Cost	82,370
	Annual Unit Cost	$3.16/Ton

O&M- OPERTION AND MAINTENANCE
Yr.- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-7

BASIC LANDFILL COST ASSUMPTIONS
1000 TPW

EQUIPMENT - TABLE A

	YR.	CC	%	OWNING	%	OPERATION & MAINTENANCE
1 115Hp Crawler	5	$ 36,000	24	$ 8,546	22	$ 8,000
1 170Hp Crawler	5	52,000	24	12,345	22	12,000
1 Fuel Port	5	3,000	24	712	7	200
Scales	10	10,000	14	1,359	10	1,000
		$101,000		$22,962		$21,200

PERSONNEL - TABLE B

Super & Scalemen	1	@ 2080 Hr. @ $8.17/Hr.	$17,000
Equip. Oper. 1.5	1.5	$24,000/Year	36,000
Labor	2		16,640
			$69,640

FACILITY COST ESTIMATE TABLE C

		YR.	CC	@%	A.C.
1.	Design	25	$ 17,500	8	$1,369
2.	Preparation	25	25,000	8	1,956
3.	Building Facilities	25	8,000	8	640
4.	Equipment	Varies	101,000	-	22,962
	Sub-Total		$151,500		
5.	Supervision & Inspection	25	7,070	8	566
	Sub-Total		$158,570		
6.	Contingency 10%	25	15,857	8	1,269
	Sub-Total		$174,427		
7.	Legal 3%	25	5,233	8	418
	Sub-Total		$179,660		
8.	Bond Discount 3%	25	5,390	8	431
	TOTAL CAPITAL COST		$185,050		$29,611

A.	Line 1-8	$29,611
B.	Equipment	21,200
	Facility 50% of CC-3	4,000
	Miscellaneous 3% of CC-2	750
		$55,561
C.	Salaries	69,640
	Total Annual	$125,201
	Annual Unit Cost at 962 T/W at 52 W/Yr.	$2.50/Ton

O&M- OPERATION AND MAINTENANCE
Yr,- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-8

BASIC LANDFILL COST ASSUMPTIONS

2000 TPW

EQUIPMENT TABLE A

	YR.	CAPITAL COST	%	OWNING	%	O&M
Crawler 195 Hp.	5	$ 58,000	24	$13,770	24	$13,800
Crawler 300 Hp.	5	86,000	24	20,417	22	19,000
Front End Loader 100 Hp.	5	31,000	24	7,360	19	6,000
Fuel Supply	5	5,000	24	1,187	8	400
Scale	10	11,000	14	1,495	14	1,500
		$191,000		$44,229		$40,700

PERSONNEL COSTS TABLE B

Supervisor & Scale	1 @ 2080 @ $8.2/Hr.	$17,056
Laborer	2 @ 2080 @ $4./Hr.	16,640
Equip. Operator	2.5 @ $11.50/Hr and 2080 Hrs.	59,800
		$93,496

FACILITY COST ESTIMATE TABLE C

		YR.	CC	@%	AC
1.	Design	25	$20,000	8	$ 1,565
2.	Site Preparation	25	30,000	8	2,347
3.	Building Facilities	25	21,620	8	1,691
4.	Equipment	Varies	191,000	-	44,229
	Sub-Total		$262,620		
5.	Supervision & Inspection	25	10,982	8	879
	Sub-Total		$273,602		
6.	Contingency - 10%	25	27,360	8	2,189
	Sub-Total		$300,962		
7.	Legal 3%	25	9,029	8	722
	Sub-Total		$309,991		
8.	Bond Discount 3%	25	9,299	8	744
	TOTAL CAPITAL COST		$319,290		$54,366

ANNUAL COST

A. Lines 1-8	$54,366
B. Equipment	40,700
Facility 50% of CC-3	10,810
Miscellaneous 3% of CC-2	900
C. Salaries	93,496
Total Annual Cost	$200,272
Annual Unit Cost	$2.00/Ton

O&M- OPERATION AND MAINTENANCE
Yr.- NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST
@% - % CAPITAL RECOVERY PER YEAR
AC- ANNUAL CAPITAL RECOVERY VALUE

Table B-9

BASIC LANDFILL COST ASSUMPTIONS

5000 TPW

EQUIPMENT TABLE A

NO.	YR.	CAPITAL COST	%	OWNING	%	O&M
1. Crawler 195Hp.	5	$ 58,000		$13,770		$13,800
2. Crawler 300Hp.	5	86,000		20,417		19,000
170Hp.	5	52,000		12,345		12,000
1. Loader 300Hp.	5	31,000		7,360		6,000
1. Scraper 150Hp.	5	49,000		11,633		18,000
1. Truck Pick-Up	4	4,000	29	1,160	46	1,840
1. Fuel Truck	5	13,000	24	3,086	35	4,500
1. Water Tank Truck	5	12,000	24	2,849	35	4,000
Motor Grador	5	31,000	24	7,360	13	4,000
Scale	10	25,000		3,397		3,000
		$361,000		$83,377		$86,140

PERSONNEL COSTS TABLE B

5 Operators @ $11.50/Hr. @2080	$120,000	
4 Laborer $4.00/Hr.	33,280	
2 Scale Operator @ $11066./Year	22,132	Based on Ratio of Lab/Sc.Op.
1 Supervisor @ $17,000 @ $8.2/Hr.	17,000	Based on Ratio of Sc. Op/Sup.

FACILITY COST ESTIMATE TABLE C

	YR.	CC	@%	AC
1. Design	25	$ 25,000	8	$ 1,956
2. Preparation	25	40,000	8	3,129
3. Building Facilities	25	27,244	8	2,131
4. Equipment	Varies	361,000	-	83,377
Sub-Total		$453,244		
5. Supervision & Inspection	25	16,444		1,316
Sub-Total		469,688		
6. Contingency 10%	25	46,969		3,758
Sub-Total		$516,657		
7. Legal 3%	25	15,500		1,240
Sub-Total		$532,157		
8. Bond Discount 3%	25	15,965		1,277
		$548,122		$98,184

O&M - OPERATION AND MAINTENANCE
Yr. - NUMBER OF YEARS AMORTIZED OVER
CC - CAPITAL COST

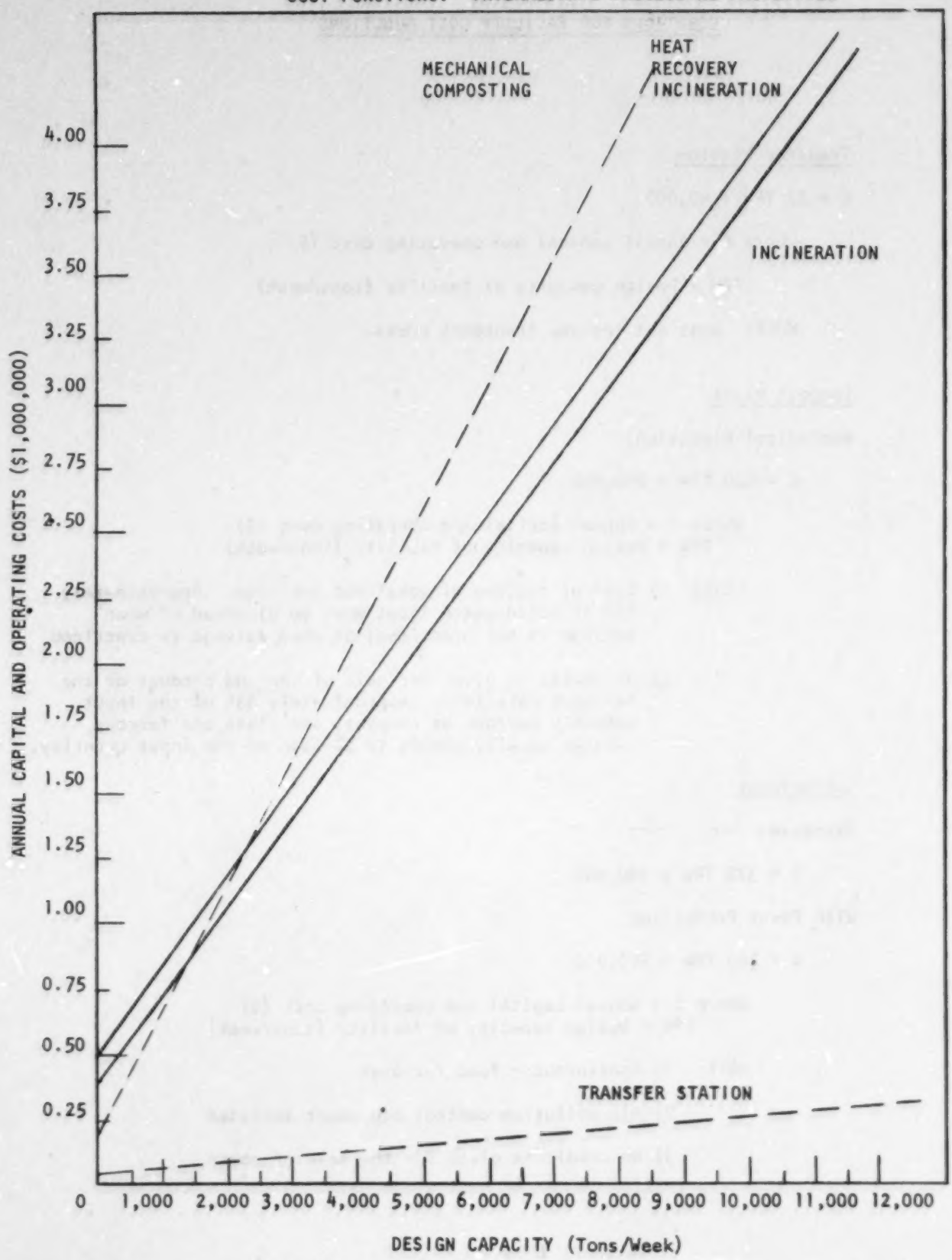
@% - % CAPITAL RECOVERY PER YEAR
AC - ANNUAL CAPITAL RECOVERY VALUE

TABLE B-9 Continued

A.	Sum 1-8	$98,184
B.	Equipment	86,140
	Facility	13,622
	50% of CC - 3 Miscellaneous	1,200
C.	3% of CC - 2 Salaries	$192,412
	Annual Cost	$391,558
	Annual Unit Cost	$1.50/Ton

Figure B-2

COST FUNCTIONS: INTERMEDIATE PROCESSING FACILITIES



EQUATIONS FOR FACILITY COST FUNCTIONS

Transfer Station

$C = 22\ TPW + 40{,}000$

Where C = Annual capital and operating cost ($)

TPW = Design capacity of facility (tons/week)

NOTE: Does not include transport costs.

Compost Plant

Mechanical Digestion:

$C = 500\ TPW + 200{,}000$

Where C = Annual capital and operating cost ($)
TPW = Design capacity of facility (tons/week)

NOTE: 1) Cost of residue disposal not included. Approximately 15% of solid waste input must be disposed of when salvage is not practiced; 5% when salvage is practiced.

2) No credit is given for sale of the end product or the salvaged materials. Approximately 33% of the input quantity emerges as compost, and glass and ferrous salvage usually amount to 5% each of the input quantity.

Incinerator

Standard:

$C = 320\ TPW + 400{,}000$

With Power Production

$C = 340\ TPW + 500{,}000$

Where C = Annual capital and operating cost ($)
TPW = Design capacity of facility (tons/week)

NOTE: 1) Continuous - feed furnaces

2) Air pollution control equipment included

3) No credit is given for the sale of power

Sanitary Landfill

Capital Cost: Consultant's estimate for each individual case.

Operating Cost:

$C = 84\ TPW + 30{,}000$ when $TPW \leq 3{,}000$
$C = 38.5\ TPW + 160{,}000$ when $TPW > 3{,}000$

Where C = Annual operating cost ($)
TPW = Operating level (tons/week)

The curve that best fit the cost data is described by the following equation:

$$C = 0.62 \log TPW + 3.24$$

Since only linear equations are acceptable to the optimization routine, two linear equations were fitted to the curve aroung the specified breakpoint which yielded the two linear equations above.

RESOURCE RECOVERY FACILITY AND COST

The following system was designed to process up to 750 tons per day of municipal solid waste based upon a 2-shift operation. The system will shred all waste, magnetically separate ferrous metals and separate heavy and light fractions. Two shredders are provided to assure continuous service. The system will produce: shredded fuel, ferrous metals, and a mixture of glass and non-ferrous metals.

This estimate does not include the power plant handling and transportation costs. Included in the building cost is a pile foundation.

This system was designed in 1973 for the City of New Orleans by the National Center for Resource Recovery, but has not been constructed. The construction and operating costs included herein are unvarified estimates of cost.

TABLE B-10

FACILITY (750 Tons/Day, 2 Shift)

	MATERIALS	LABOR
Scale	57,375	6,715
Front End Loader	58,300	-
Municipal Solid Waste Conveyor System	201,235	14,740
Reject Bin (large objects)	6,985	-
Trommel Screen	143,185	11,120
Trommel Discharge Conveyor	12,445	19,085
Shredder Feed Conveyor	20,005	19,085
Shredder (2)	563,615	18,790
Shredder Discharge Conveyor	45,545	805
Air Classifier	270,960	42,190
Magnetic Separator	28,000	7,000
By-pass Conveyor	25,380	2,115
Shredder Materials Conveyor System	58,235	2,115
Heavy Materials Conveyor System	25,875	4,935
Electrical System	51,650	10,075
	$1,574,890	$158,770
Building, Receiving (1,000 Ton Storage)	182,880	14,590
Asphalt Apron	14,750	12,010
Shredder Building	113,305	79,500
	$ 310,935	$106,100
Engineering, Contingencies, Profit	510,385	
Total Cost	$2,661,080	

TABLE B-10 (Continued)

OPERATING COST

Amortization (10 Years @ 8%)	
2,661,080 (CRF 10 Years @ 8%) 0.149 ÷ 12 =	45,500
Power, water	14,538
Shredding	23,469
Recovery	28,608
Cost per Month	$112,015

Total Annual Cost $1,340,000

750 Tons/Day x 6 Day/Week x 52 Weeks/year = 234,000 Tons/Year

Cost per Ton = $5.73

@ 500 Tons/Day x 312 Days/Year = 156,000 Tons

Cost Per Ton = $8.60

BIBLIOGRAPHIC DATA SHEET	1. Report No. IIEQ 74-12	2.	3. Recipient's Accession No. PB291405
4. Title and Subtitle: Champaign County Solid Waste Management System Analaysis			5. Report Date: 3/1974
			6.
7. Author(s)			8. Performing Organization Rept. No.
9. Performing Organization Name and Address: Roy F. Weston, Inc. Weston Way, Westchester, Pennsylvania 19380			10. Project/Task/Work Unit No. 40.001
			11. Contract/Grant No.
12. Sponsoring Organization Name and Address: Ill. Institute for Environmental Quality 309 W. Washington St., Chicago, IL 60606			13. Type of Report & Period Covered: Final
			14. 200/01

15. Supplementary Notes

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16. Abstracts

In 1973, the Illinois Pollution Control Board adopted new regulations for sanitary landfills. These regulations are enforced by the Illinois Environmental Protection Agency. The permit and inspection provisions established under these regulations are among the most comprehensive and vigorous in the United States. Each landfill operator is required to apply for a permit by April 27, 1974. The expense of meeting Illinois design and operating standards has and probably will cause some marginal landfill operations to close, thereby eliminating some environmentally unacceptable, but convenient, disposal sites.

17. Key Words and Document Analysis. 17a. Descriptors

WASTES
WASTE DISPOSAL
WASTE TREATMENT

17b. Identifiers/Open-Ended Terms

Solidwaste Management-Champaign/County, Illinois
Landfill-Illinois

17c. COSATI Field/Group 13B Civil Engineering

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